tunately, ships' reports were unusually few from the ocean's western half, but such as were received from that area gave no indication of winds stronger than force 6 or 7 in the extreme being experienced.

For the upper eastern half of the ocean, gales were reported on 2 days. The earlier, on the 5th, was of force 8, experienced by the American steamship *Denali*, near 54° N., 162° W. The latter, on the 9th, gave evidence of considerable local energy in connection with a cyclone over and south of the Gulf of Alaska. Between 7 and 8 a. m. of that date, the American steamer *W. S. Miller* enc ountered a west wind of force 11, lowest barometer 994.9 millibars (29.38 inches), in 49°42′ N., 146°30′ W.

Tropical cyclones.—Subjoined is a report by the Rev. Bernard F. Doucette, S. J., Weather Bureau, Manila, P. I., on three depressions and four typhoons that occurred over the Far East during the month.

In the southeastern Tropics a minor tropical cyclone with a rapid west-northwestward progression, is evidenced by the reports of the three following ships: The American steamer *Agwidale* met an east wind of force 7, with slightly depressed barometer, south of Acapulco on the 3d. On the 4th the steamship *Liberator* encountered an east-southeast gale of force 8, lowest barometer 1,005.4 millibars (29.69 inches), near 16° N., 113° W. On the 5th the steamship *City of Alma*, near 18° N., 120° W., ran into a north-northeast gale of force 8, with barometer at 1,008.5 millibars (29.78 inches), uncorrected.

On the 17th and 18th slightly disturbed conditions, with some fall in barometer, were observed off the lower Central American coast. These were followed by the report of a north-northeast wind of force 7 on the 20th south of the Gulf of Tehuantepec. The observations point to the existence of an incipient depression moving northwestward from a position in unusually low latitudes in these waters.

Fog.—Some 10 to 20 percent of days with fog was reported along the central and western parts of the northern steamship routes. This is much less than the normal occurrence for August, and undoubtedly the unusual lack of observations accounted, in some measure at least, for the apparent fog deficiency. Along the American coast fog was reported as follows: Off Washington on 5 days; off Oregon on 6 days; and off California on 14 days.

TYPHOONS AND DEPRESSIONS OVER THE FAR EAST

By Bernard F. Doucette, S. J.

[Weather Bureau, Manila, P. I.]

Depression, August 2–5, 1940.—A depression, apparently of minor importance, formed about halfway between the Philippines and the Mariana Islands. It moved along a north-northwesterly course, inclining to the north and northeast, thus passing about 150 miles northwest of the Bonins as a weak low-pressure area.

Depression, August 12–15, 1940.—A mild depression formed about 400 miles east-northeast of San Bernardino Strait, and moved west and west-northwest to the ocean regions about 300 miles east of northern Luzon where it disappeared. There was no evidence of intensification during the course of this disturbance.

Typhoon, August 13–18, 1940.—A weak depression was central about 60 miles east of Mindoro during the morning hours of August 13. This disturbance moved southwestward and westward, passing south of Mindoro and Culion Islands on its way to the China Sea. Moving west, then west-northwest, it proceeded toward Indochina, apparently a depression during these days. When about 120 miles southeast of Tourane, August 16, it was definitely a typhoon, small in area, but with pressure falling fast. The typhoon moved northwest, almost parallel to the coast, and disappeared over the Gulf of Tong King. Pressure values at coastal stations, Tourane to Vinh, were close to 750 mm. (999.9 mb.), August 16 to 18.

Typhoon, August 14–24, 1940.—As a low-pressure area east of Guam, this storm moved northwesterly, then westerly, apparently increasing to depression strength. On August 16, it became a typhoon, moving west and west-southwest for 1 day, reaching the 15th parallel of latitude. On August 17, it was threatening central Luzon, but a shift to the north-northwest placed northern Luzon in danger. The center entered northern Luzon late in the afternoon of August 18 north of Palanan, Isabela Province, passed between Tuguegarao and Aparri, Cagayan Province, and entered Balintang Channel north of Laoag, Ilocos Norte Province, August 19, moving west-northwest. Over the northern China Sea, the center moved close to and north of Pratas, threatening the locality of Hong Kong. It shifted to the west, however, the center passing very close to Gap Rock, after which the storm moved southwest to Hainan Island. A change to the west brought the center across the Gulf of Tong King and into the Continent about 60 miles south of Phulien, where it weakened. No trace of the storm could be found on the weather maps of August 25.

Barometric minima recorded at northern Luzon stations are listed as follows: Palanan, Isabela Province had 731.3 mm. (975.0 mb.) with northwest winds of force 9, at 5:30 p. m. of the 18th; Tuguegarao, Cagayan Province had 736.9 mm. (982.5 mb.), with west winds of force 7, at 11:05 p. m. of the 18th; Aparri, Cagayan Province had 733.9 mm. (978.5 mb.), with southeast winds force 7, at 3:45 a. m. of the 19th; Calayan, Babuyan Islands, had 742.93 mm. (990.5 mb.), with southeast winds of force 5, at 2 p. m. of the 19th; Laoag, Ilocos Norte Province had 742.9 mm. (990.5 mb.) with northwest winds of force 6, at 6:20 a. m. of the 19th. A few days later, after the storm had passed Hong Kong, the following message was received from the Royal Observatory at Hong Kong: "Barometric minimum Hong Kong Observatory, 29.215; Gap Rock, 29.07; center probably 28.8, maximum wind gust, 83 m. p. h."

Nine lives were lost as the typhoon crossed Luzon, most of these casualties occurring in central Luzon. The steamship *Nanyo Maru* was wrecked near Nagabungan, Pasugun, Ilocos Norte Province, the ship being totally destroyed, but the passengers and crew were rescued. The provinces of central Luzon had floods over large areas for a few days. No other reports of destruction were published.

The preceding typhoon, August 13–18, formed as the southwesterly current moved across the southern part of the China Sea to Zamboanga and Cebu, this taking place on August 10 and following days. Then the depression (for it apparently was not of typhoon strength as it crossed the China Sea) intensified when the circulation was able to draw upon the rather strong southwesterly current flowing over Thailand and southern Indochina. This process occurred while a disturbance over the Pacific was approaching the archipelago, and the same procedure, so it seems, took place over the southern Philippines. Velocities of the wind over Cebu and Zamboanga increased to values of 50 k. p. h. or more after August 16, Cebu usually being stronger than Zamboanga. A few days

264472—40—2

later, as the storm was crossing northern Luzon, velocities over 100 k. p. h. were recorded at Manila and Cebu, the directions always being from the southwest, west, or northwest quadrants at these stations. It seems to the writer that the air stream over the southern part of the archipelago was not only being attracted toward the typhoon center, but also was being impelled toward the disturbance by forces far to the southwest of the Philippines, both of these tendencies making the storm very intense. Observations from the Straits Settlements and the Netherlands East Indies are not available for confirming these impressions.

Depression, August 19–25, 1940.—A low-pressure area appeared far to the southeast of Guam, moved west, then west-northwest as a depression, and disappeared about 400 miles northeast of San Bernardino Strait. This disturbance did not manifest any signs of intensification.

Typhoon, August 20–27, 1940.—A depression appeared about 350 miles north of Yap and moved northwest, rapidly intensifying to typhoon strength. When about 120 miles south-southeast of Naha, Nansei Islands, it changed its course to the north, then later recurved to the east-northeast when it reached the regions about 120 miles west-northwest of Oshima, Nansei Islands. The storm then moved almost parallel to the coast line of Japan, entering the mainland, however, and passing west of Tokyo on its course toward the northern Pacific. By August 27, it seemed that the storm had degenerated into a mild low-pressure area, moving northeast.

When the typhoon was moving over the Eastern Sea and adjacent regions, the lowest pressure plotted on the weather map was the afternoon observation of August 23, from Naha, Nansei Islands, a value of 740.0 mm. (986.6 mb.) with northwest winds of force 6. No reports of extensive damage due to this typhoon were published.

Typhoon, August 23–September 4, 1940.—As a depression, central about 250 miles east-northeast of Guam, August 23, at 2 p. m., this storm moved west-northwest, then west, then southwest, rapidly intensifying to typhoon strength. When the center reached the 14th parallel of latitude, it again moved west, shifting to the west-northwest at longitude 134°. This brought the storm center to the eastern portion of the Balintang Channel, where it inclined to the north. The center avoided the town of Basco, Batan Islands, and continued toward Formosa. As well as could be determined, the typhoon passed over northern Formosa, moving northwesterly, and continued toward China. On August 31, the center entered China close to Foochow, and recurved to the northeast during the next 2 days. This caused the storm to pass about 150 miles west of Shanghai on its way to the Yellow Sea, Chosen (Korea), and the Sea of Japan, where it disappeared on September 4.

The minimum pressure at Basco, Batan Islands, was 740.6 mm. (987.4 mb.), at 3 a. m. August 30, with west-southwest winds of force 6. On August 31, at 2 p. m. (Manila time), Foochow reported north winds of force 10, with pressure at 734.0 mm. (978.6 mb.).

The upper winds at Guam hardly reached velocities as high as 40 k. p. h., as this storm approached the vicinity of the station, but it must be noted that the weather was unfavorable for long ascents. On August 25 velocities up to 54 k. p. h. were reported, direction south-southeast, and weakening the next day. It might be remarked that there were no strong velocities reported from this station during the whole month, when three storms passed by these ocean regions. Over the Philippines, the southwesterly air stream, quite strong as the typhoon approached, was intensified somewhat on August 28 and following days, but not to the strength manifested during the typhoon of August 14 to 24.

RIVER STAGES AND FLOODS

By Bennett Swenson

Outstanding during August were the severe floods in the rivers of southern Virginia, North Carolina, and portions of South Carolina, Georgia, and eastern Tennessee. These floods resulted from excessive precipitation accompanying the passage inland of a tropical disturbance near Savannah, Ga., on August 11. The disturbance moved slowly to the southern Appalachian Mountain region and on the 13th turned and moved slowly eastward along the North Carolina-Virginia border, passing out to sea again on the night of the 17th. (See pp. —— for a complete report on the hurricane.)

As is common with the slow movement of any disturbance where there is a strong convergent influx of warm moist air, the cumulative rainfall amounts were exceedingly high. The rainfall was heaviest over the mountains due to the extra uplift of moist air caused by the mountain slopes.

The rivers most severely affected were the James, Roanoke, Tar, New River in Virginia, Tennessee Valley above Knoxville, Tenn., and other streams rising in the eastern slope of the mountains in western North Carolina. Previous high stages of record were exceeded at a number of places. At Weldon, N. C., on the Roanoke River, a stage of 58 feet was reached on August 18, exceeding the great flood of 1877 by about 5 feet at that place.

Floods of lesser magnitude occurred in the Neuse, Cape Fear, Peedee, Santee, Savannah, and Altamaha River systems.

By reason of the difficulty in securing and preparing the necessary meteorological and hydrologic data for publication, a detailed account of these floods will be given in a later issue of the Review. The dates above flood stages and the crest stages are given in the table at the end of this report.

FLOODS IN OTHER RIVERS

East Gulf of Mexico Drainage.—Stages in the Chattahoochee and Flint Rivers remained at low stages, except in the upper portion, despite excessive rains in portions of northern and eastern Georgia. The only station reporting stages above flood was Norcross, Ga. on the Chattahoochee River, and this lasted only briefly.

The Etowah River at Cartersville, Ga. reached a stage of 19.8 feet (flood stage 18 feet) on the 14th.

The Pearl River had dropped below flood stage at the beginning of the month except at Pearl River, La. where flood stages continued until August 9.

Ohio River Basin.—In addition to the flood in the French Broad River on August 13 and 14, another occurred on August 29 to 31. The second was the more severe and was due to exceptionally heavy rainfall confined almost entirely to the headwaters of that basin. The 24-hour rainfall amounts ending at 7:30 a. m. of the 30th were 12.10 inches at Mount Mitchell and 6.78 inches at Asheville, N. C. However, the crest stage in the Tennessee River at Knoxville, Tenn. in the second rise was lower than in the first due largely to the fact that in this case the discharge of the Holston River was not as great.

The New River in Virginia and West Virginia, a tributary of the Kanawha River, which experienced unusually high stages as a result of the heavy rains accompanying the movement inland of the hurricane